

BEFORE THE

ORIGINAL

Federal Communications Commission

WASHINGTON, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF SECRETARY

In the Matter of)

Amendment of the Commission's Rules
to Establish Part 27, the Wireless
Communications Service ("WCS"))

GN Docket No. 96-228

To: The Commission

COMMENTS OF TRW INC.

TRW Inc., a manufacturer of commercial, scientific, and military communications satellites for more than 25 years, hereby submits these comments in opposition to the Petition for Expedited Reconsideration filed jointly by PACS Providers Forum and DigiVox Corp., in the above-captioned proceeding on March 11, 1997 (hereinafter "PACS Petition"). TRW's Space & Electronics Group has built more than 190 communications, scientific and defense spacecraft; produced, integrated and tested more than 130 payloads; developed more than 200 advanced space instruments; and integrated some 550 experiments into spacecraft. TRW has built communications satellites or payloads for the U.S. Navy's Fleet Satellite Communications spacecraft, NASA's Tracking Data and Relay Satellites, the Department of Defense's Milstar satellites and is a founding partner in Odyssey Telecommunications International, Inc., a personal satellite communications service. Odyssey™ provides telecommunications services to mobile and fixed terminals through S-Band and L-Band links.

TRW, which has longstanding and continuing interests in the development of the commercial satellite industry,¹ is concerned about any effort which adversely affects the use of allocated satellite frequency bands, particularly if such effort brings into question the continued validity of a particular satellite service.² Unfortunately, the PACS Petition is one such effort. Other than complaining that the Commission failed to take into account certain *ex parte* filings made on behalf of DigiVox (PACS Petition at 5), petitioners offer no record evidence that the Commission's initial determination in this respect is in error.³ Moreover, the PACS Petition ignores the fact that the DigiVox claims were the subject of opposition pleadings by the satellite DARS applicants and others which the Commission considered along with the DigiVox initial *ex parte* filing.

In the WCS Order, the Commission devoted extensive analysis to out-of-band emissions issues not only for the DARS, but for radioastronomy, flight test, and in-band WCS services. The PACS Petition fails to demonstrate how the delicate balance reached by the

¹ TRW, as noted, is the FCC licensee of the Odyssey™ global, mobile satellite service in the 1610-1626.5 GHz band. See Order & Authorization, 10 FCC Rcd 2263 (1995), Erratum, 10 FCC Rcd 3924 (1995), Order & Authorization, DA 96-1923, Released November 19, 1996.

² In connection with the Odyssey™ system, for example, TRW is actively engaged in proceedings in a variety of fora to ensure that protection levels sought for the benefit of the Russian Glonass aeronautical radionavigation system do not unnecessarily impinge on the ability of the MSS industry to provide a commercially viable service.

³ See Amendment of the Commission's Rules to Establish Part 27, the Wireless Communications Service, Second Report & Order, GN Docket No. 96-228, released February 19, 1997 (DA 97-50) (hereinafter "WCS Order") at ¶¶ 123-144.

Commission in the WCS Order fails to serve the overriding public interest in ensuring that *all* services can operate free from unnecessary interference. It offers no new information to the Commission nor does it present new matters for its consideration.

According to the PACS Petition (see pages 8,10), the principal concerns which the Commission is being asked to consider above all others, is the cost of asserted "major alterations to equipment" and the likelihood that certain mobile services could no longer be provided under the current state of technology. But, even if these assertions are true — which we show below is not the case — they do not outweigh the Commission's carefully considered decision that more critical to the public interest is the need to allow other new technologies to come to market free from unnecessary technical constraints and, in addition, its finding that other avenues existed which would permit petitioners to offer the variety of services they desire.⁴

Although TRW has not participated in earlier aspects of this proceeding, it has reviewed the technical arguments made in opposition to the PACS Petition and, in large measure, finds them compelling refutations of the DigiVox/PACS technical claims.⁵ In addition, however, as a satellite provider TRW is concerned with errors and misstatements made with respect to the out-of-band ("OOB") emission requirements. In designing and fielding many satellite

⁴ See WCS Order at ¶¶ 138,143. It is important to note in this context that terrestrial wireless operators have many alternative bands in which to operate.

⁵ See, Opposition to Petition for Expedited Reconsideration filed March 21, 1997 by Satellite CD Radio, Inc., Opposition of Digital Satellite Broadcasting Corporation to Petition for Expedited Reconsideration, filed March 21, 1997, and Opposition to Petition for Expedited Reconsideration filed by Primosphere Limited Partnership on March 21, 1997.

communications systems TRW is well aware of the havoc that terrestrial equipment can cause to reception of satellite downlinks unless proper attention is applied to emission requirements and coordination issues. Satellite links are limited in available power and bandwidth. Due to the physical and technical limitations on the power of satellites, extreme care must be given to designing links with proper margin to overcome atmospheric attenuation, multipath and blockage degradation. This allows maximum use of the costly satellite resources. Large degradation to link performance due to terrestrial interference must be avoided or tightly constrained. Recognizing the importance of this issue, as noted above (see footnote 2), TRW has participated in discussions with the Commission in the past few years to ensure that MSS handsets would not interfere with the space-based GPS and GLONASS systems.

TRW is disturbed with the cavalier attitude terrestrial filers, in this case DigiVox, have taken in assessing the impact of their interference on satellite broadcast links. The DigiVox analysis is based upon an assumption that the OOB emissions for a single handset should be allowed to raise the SDARS receiver noise floor by 2 dB. (In our satellite link designs, we attempt to limit "non-thermal" noise interference sources to 0.1 dB.) Downlinks are designed with a specific margin in the absence of interference (e.g., WCS) to provide the required quality of service. By raising the SDARS receiver noise floor by 2 dB, the satellite provider would have to raise the transmitted power level by nearly 60 percent to provide the same quality of service. Clearly, this could render the service infeasible.

DigiVox dismisses the SDARS noise floor claimed by some of the SDARS filers without any engineering basis. Although TRW is not a supplier of vehicular radios, we have

worked closely with a number of leading cellular telephone suppliers in connection with the Odyssey™ system. Based upon our experience, we believe that a system noise temperature of 400 deg-K for an S-Band vehicular radio is a bit optimistic, but that a temperature of 450 deg-K would be readily achievable (increase in noise floor of 0.5 dB). We believe that DigiVox did not understand statements by the filers that they would not utilize a filter in front of the LNA. This filtering is required for duplex communications such as cellular systems but can be placed behind the LNA, thus avoiding the sensitivity impact, for receive-only services.

Further, as pointed out by Digital Satellite Broadcasting Corporation ("DSBC"), evaluating the impact of the pulsed low rate PACS signal on the higher rate SDARS downlink by merely comparing the average rise in the noise floor is not appropriate. When pulsed interference levels are high enough to destroy reception of large number of bits, changing the power level of the interference will not affect the number of bits affected. Averaging the power is reasonable if the interference is present for only a portion of the bit period; i.e., if the interference "on-time" is shorter than the downlink bit period. This is the case for CDMA systems such as Odyssey™ but not for TDM systems such as proposed by the SDARS filers. The following example illustrates this point. Suppose a SDARS system normally has 6 dB of link margin, and a PACS handset has a pulsed power level that causes a 0.5 dB increase to the average SDARS receiver noise floor over a 12.5 % duty cycle. Looking at it in the context of "average" power, this is a relatively benign impact upon the SDARS service. However, in the real-world, we agree with the SDARS filers that during the period that the TDMA PACS signal is being transmitted, the interference

power will be 9.5 dB above the SDARS noise floor, effectively destroying 1/8 of the received data bits.

Since the filers have indicated that the distance at which a PACS handset destroys SDARS bits is on the order of 50 ft or more (i.e., where the peak interference power is significantly above the SDARS noise floor), it is not unlikely that there could be multiple PACS handsets corrupting SDARS reception for individual users. Since each PACS handset destroys 1/8 of the SDARS bits, it does not take too many handsets to overwhelm the SDARS decoder. Just as in the MSS case, SDARS systems are operating under difficult power and bandwidth constraints, and additional error correction coding is unlikely to be able to deal with the high level of interference from (multiple) PACS handsets.

DigiVox makes an erroneous claim that since the SDARS systems employ advanced signal processing techniques to deal with signal blockage, these techniques would eliminate problems with PACS. The two problems are much different; therefore, the solutions have different impacts on performance. Signal blockage occurrences are uncorrelated events whereby reception is disrupted relatively infrequently for periods of time that last on the order of seconds. Diversity techniques and interleavers can be employed to redistribute these error blocks over longer periods so that conventional error coding can be used to recover the transmitted signal. PACS interference on the other hand will continuously disrupt reception, destroying (as acknowledged by DigiVox) one out of every eight bits continuously. Much more robust error correction coding would need to be designed into the links and multiple interferers would make this practically impossible. Even if possible, due to bandwidth and power limitations, such

additional coding might not be feasible without severely reducing the number of channels that can be supplied by the SDARS satellites.

From simple analysis, it is clear to TRW that the proposed OOB emission relaxation will preclude the ability to provide SDARS service. We do not understand the need for the relaxation. Nowhere in its filings does DigiVox explain why it cannot change its equipment to make emissions compliant with the present requirement. Since the PACS transmitters operate in a linear mode, appropriate choice of modulation techniques will avoid pollution by "signal" power. Wideband noise sources will produce emissions above the specification limit, but straightforward filtering can be employed to bring the service into compliance. Since the PACS system is relatively low power, the insertion loss of these filters can easily be recovered in the transmitter stage.

Rather than relying upon outrageous claims based upon dubious averaging techniques, the Commission should retain the limits previously adopted and encourage WCS equipment suppliers to improve their equipment to avoid tainting services outside their assigned bands. TRW feels that it is unreasonable for the PACS providers to totally dismiss the feasibility of making any changes to their equipment. Modifications to this inexpensive equipment are easy to implement. In contrast, satellite systems have little or no ability to shield against adjacent band pollution into the frequencies in which they operate.

It is important to note, in this connection, that satellite designs — which no doubt in this case have been in place for many, if not all, of the DARS applicants for some time now — can not easily be revamped on a whim. Many technical ramifications will result from less stringent

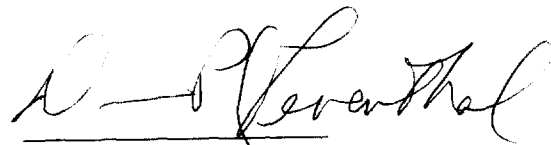
out-of-band emissions than the applicants have long presumed would protect their service. The satellite hardware changes necessary to accommodate operation of WCS at the OOB emission levels requested by DigiVox are beyond the current state of the art in terms of satellite power.

CONCLUSION

For the foregoing reasons, and others set forth in pleadings submitted by the DARS community, the FCC should not alter the out-of-band emissions limits set out in the WCS Order.

Respectfully submitted,

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March 28, 1997

CERTIFICATE OF SERVICE

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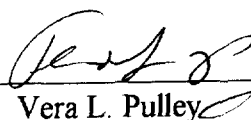
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